Examining the Potential Use of Geospatial -Informatics Technologies to Engage Northern Canadian First Nation Youth in Environmental Initiatives

by

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AUTHORS DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

CO-AUTHORS DECLARATION

This thesis contains material that was developed as the result of cooperative research. The research, data collection and analysis were done by Andrea Isogai. Dr. Leonard Tsuji and Daniel McCarthy provided guidance in research and writing, as well as coordinating contact and meetings with members in Fort Albany. Dr. Karagatzides and Holly Gardner assisted with the programming and development for the educational outreach program. Vicky Edwards a community member of Fort Albany aided in the organization and collection of participants as well as taking on the role of community liaison. Don Cowan contributed technical knowledge and skills in the development and use of the collaborative-geomatics informatics tool used in this research. Christine Barbeau, Nadia Charania, and Skye Vandenberg aided in running the environmental outreach program.

ABSTRACT

Having experienced climatic warming before, First Nations people of the Albany River basin in sub-arctic, Canada, have already shown the ability to be adaptable to external influences. However, societal changes and the current accelerated rate of environmental change have reduced First Nations people ability to adapt. In addition, young people are no longer going out on the land as much. Fort Albany First Nation community members have commented on the lack of connection that some youth have with the land. A disconnect with the environment by youth can threaten the adaptive capacity of sub-arctic First Nations. As identified by Fort Albany First Nation community members, one potential tool that could influence the youth to become more aware of their land, is the collaborative geomatics tool. The collaborative geomatics tool is based on the WIDE (Web Informatics Development Environment) software toolkit. The toolkit was developed by The Computer Systems Group of the University of Waterloo to construct, design, deploy and maintain complex web-based systems. The toolkit is unique in that it allows for a forms-based/wizards-based approach to system construction that supports the rapid development and modification of the system. The collaborative geomatics tool supports a common reference map, based on high-resolution imagery. Some of the basic features of the collaborative geomatics tool includes the entry of real-time geospatial information (oral, written and visual [photographic, video]) that is securely housed within the system through accessibility safeguards. I examined in Chapter 2, the potential use of the collaborative geomatics tool to connect today's youth with bushmen and Elders, allowing for knowledge transfer. I employed educational strategies that have been shown to result in greater Aboriginal student success (e.g., working in small groups, hands-on learning) in a community-based summer camp and after-school program.

The outreach initiative included traditional hands-on activities with experienced bushmen - such as, setting nets for whitefish and removal of the fish from the nets, and smoking of the whitefish with an Elder - GPS units were used to take geo-tagged pictures of the activities by the participants. The primary author provided some hands-on training on the collaborative geomatics tool. The students were able to upload the geo-tagged pictures that they had taken, onto the collaborative geomatics tool, with some assistance. Students were able to see spatially on the collaborative geomatics tool where the nets had been set (i.e., the location of traditional fishing spots), and relate back to their experience in the boat. The students also learned from the bushmen that whitefish become plentiful in the Albany River late in the summer. This outreach project provided hands-on learning and introduced youth of Fort Albany First Nation to the collaborative geomatics tool. The students were able to collect, store, and share geo-referenced pictures. The collaborative geomatics tool has the potential to transfer intergenerational knowledge. Once the collaborative geomatics tool has been fully modified with community-input, the collaborative geomatics tool will be provided to the community at no cost, as a stand-alone system.

Worldwide, the use of mapping technologies in Aboriginal communities continues to grow, as these communities need to collect, collate, store, analyze and present data in response to resource development and to plan proactively. As with all mapping technologies, the target users have been adults; however, for continuity purposes, there is a need to engage the Aboriginal youth. In Chapter 3, I examined if placed-based learning could be used to engage Aboriginal youth living in Fort Albany First Nation, subarctic Canada, with respect to the collaborative-geomatics informatics tool. Introduction to and familiarization with the collaborative-geomatics informatics tool was facilitated through two environmental outreach camps. Qualitative methods were utilized to gauge if placed-based learning successfully engaged First Nation youth with respect to use of the collaborative-geomatics informatics tool. Results from a themed analysis revealed that placed-based learning successfully engaged the youth. Student's responses were quite positive and most showed a great level of interest for learning about their environment and utilizing the collaborative-geomatics informatics tool, and other technology. Continuation of the outreach initiative to further engage the youth is recommended.

In Chapter 4, food security issues were addressed. Food security exists when people have access to sufficient, uncontaminated, and nutritious food to meet their needs. In Canada, northern First Nation communities experience unique challenges with respect to food security, as food needs to be flown in by plane. Thus, food is not always accessible and very expensive. In order to combat food insecurity, northern communities are beginning to focus on making healthy foods, such as, fruits and vegetables more available and accessible through local-food interventions. In one subarctic First Nation, home and agroforestry-community gardens have been started. Agroforestry is an ancient practice of combining woody shrubs (including trees) with crops. It is important to involve the youth in this initiative if it is ever going to be sustainable, as the youth are the leaders of tomorrow. An environmental-outreach camp was used as a platform to engage youth in the local-food initiative within the community. Photovoice was used, along with other hands-on activities, to teach about food security and local food sources. Collected data were qualitative and analyzed inductively. Results indicate that youth were able to comprehend the concept of food security; they became aware of barriers and opportunities surrounding access to healthy local-food in their community.

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DEDICATION

To Matthew Marcucci, his undying support, love and patience has afforded me the opportunity to be where I am today.

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CHAPTER 1: Introduction

1.0 Introductory Comments

Canadian Aboriginal populations have strong cultural ties with their environment (Lowan, 2009; Wheaton, 2000; Berkes & Jolly, 2001; Tsuji & Ho, 2002; Wilson, 2003), allowing for the development of a valuable set of knowledge (Huntington et al., 2004; Tsuji, 1996b; Robbins, 2003; Tsuji & Ho, 2002; Berkes & Jolly, 2001; Ohmagari & Berkes, 1997). This type of knowledge is generally referred to as Traditional Environmental Knowledge (TEK), with its teachings being passed down to the youth by the Elders through several mechanisms: direct participation in a task; storytelling and narratives; and direct observation (Lertzman, 2002; Wheaton, 2000; McNally, 2004; Battiste, 2002; Ohmagari & Berkes, 1997). TEK has been defined by Berkes et al. (2000: 1252) as a complex system comprised of "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment."

As the demands of wage employment and formal schooling have limited the amount of time families have to spend together on the land and participate in traditional activities (e.g., hunting) (Tsuji, 1996b; Tsuji & Nieboer, 1999; Cordoba, 2005; Smith, 1999), transfer of knowledge between Elders and bushmen to the youth has been negatively impacted (Tsuji, 1996b; Tsuji & Nieboer, 1999; Ohmagari & Berkes, 1997; Berkes & Jolly, 2001; Aporta, 2005). In addition, as fewer youth are able to speak and comprehend their own Indigenous language (e.g., Cree, Ojibway, etc), their ability to interact with knowledge holders and Elders is affected (Battiste, 2002; Ball, 2004; Tsuji, 1996b;

McCarty et al., 2009). Declining transmission of TEK is an issue in Canada and other post-settler states like the United States, Australia and New Zealand (Biermann & Townsend-Cross, 2008; Baskerville, 2009; Smith, 2002; Kral, 2010). Specifically, youth in our study community of Fort Albany, Ontario, like many First Nation communities, are in what has been described as a "cultural-border crossings"; their community is in a state of transition between two cultures (e.g., Cree and Western culture) and the youth are caught in the middle, influenced by both (Aikenhead, 1997: 224; Riggs, 2004). Thus, an opportunity exists to utilize technology to potentially maintain and transfer TEK, inter-generationally. Indeed, Kral (2010) reported how Indigenous youth in Australia are increasingly utilizing digital technology, such as, video and audio recording software in order to create music and videos. Kral (2010) found that with the guidance of community youth programs that employed "non-formal learning or informal learning" ("learning that occurs outside of school") youth were able to contribute to the maintenance and transfer of TEK within their community (Vadeboncoueur, 2006: 240). The youth applied their technological skills and literacy to aid Elders in recording knowledge to digital media sources. As well, the youth contributed to an improved representation of what it means to be an Indigenous youth in Australia, as videos and music created and uploaded to the Internet are being used as outlets to describe personal stories and current circumstances (Kral, 2010: 13). Consequently, this technology is bridging the gap not only between generations, but also between Western and Indigenous cultures, as the youth are providing non-Indigenous people globally with a first-hand look at what it means to be an Indigenous youth (Kral, 2010: 13).

Place-based learning (also referred to as place-based education), an alternative to the formal education system (Sobel, 2008; Gruenewald, 2003; Bartholomaeus, 2006; Lowan, 2009; Lertzman, 2002; Biermann & Townsend-Cross, 2008; Baskerville, 2009; Smith, 2002), may also aid in the maintenance and transfer of TEK. Place-based learning utilizes people of the community and the surrounding environment to "enlist teachers and students in the firsthand experience of local life and in the political process of understanding and shaping what happens there" (Gruenewald, 2003: 620). Place-based learning shares similarities to the way that TEK has been reported to be taught and learnt, that is, within the local environment, holistically engaging students, both mentally and physically (Lertzman, 2002, Biermann and Townsend-Cross, 2008; Lowan, 2009). Much of the background and ideologies behind place-based learning are similar to traditional teaching practices. For example, both emphasize immersing the student in the environment to learn, appreciate community members as resources of knowledge, and are student focused. Place-based learning and traditional teaching practices encourage the student to take more control over his/her learning; while, the teacher is there for guidance. Further, both approaches attempt to encourage students to learn and apply skills and knowledge applicable to their own community (Sobel, 2008; Gruenewald, 2003; Lowan, 2009; Potter and Henderson, 2004; Lertzman , 2002). Finally, both advocates of place-based learning and traditional education have a common goal in attempting to make drastic changes to the current formal education system to better meet the needs of youth today (Battiste, 2002; Greunewald, 2003; Sobel, 2008; Lertzman, 2002; Biermann & Townsend-Cross, 2008; Lowan, 2009).

Fort Albany community members have identified the collaborative-geomatics informatics tool as a potential vehicle to transmit intergenerational knowledge between Elders and youth about their community and culture (Barbeau et al., 2011). This online mapping tool was initiated by the need for a tool to aid in planning and development discussions and collaboratively created by several First Nation communities of subarctic Ontario and the University of Waterloo (McCarthy et al., 2011). The creation of this tool is still in progress and has involved First Nation community members throughout the entire process, utilizing various culturally-appropriate research methods (McCarthy et al., 2011; Smith, 1999) In using this term, I am referring to the fact that the approach that was taken respected the community in which I worked, and ensured that their unique perspectives, culture and practices were accounted for (Smith, 1999; Simpson, 2004; Kemmis & McTaggart, 2005; Reason & Bradbury, 2010; Cammarota & Fine, 2008: viii; Chen et al., 2010; Dold & Chapman, 2011; Wang & Burris, 1997). The collaborative-geomatics informatics tool's ability to store, and present geo-referenced data in various multimedia formats (e.g., photographs, audio and video) complements traditional ways of teaching TEK (e.g., narratives and storytelling) (Barbeau et al., 2011; Battiste, 2002; Wheaton, 2000; Maina, 1997; McNally, 2004; More, 1987, Lertzman, 2002).

The collaborative-geomatics informatics tool holds the potential to provide empowerment and self-determination for subarctic First Nations. The process itself of creating the system has been an example of applying collaborative research methodologies, where the community is in control of the end product (see McCarthy et al., 2011 for further detail). When the tool is completed to the satisfaction of participating communities, it will be given to the community, and its user-friendly interface will remove the need for an expert, giving community members, full control of the content that is put into and stored on the system (McCarthy et al., 2011).

1.1 Rationale

Published literature on TEK and First Nation youth as well as direct communication with Fort Albany First Nation Elders and community members indicate the need to engage youth in the community in order to provide them with the opportunity to learn about their culture, participate in traditional activities and transfer the associated TEK (Barbeau et al., 2011; Maina, 1997; Lowan, 2009; McNally, 2004; Ball, 2004; Battiste, 2002; Berkes et al., 2000; Peloquin & Berkes, 2009; Wilson, 2003). By engaging youth in their community and environment, future generations will hopefully be better equipped to adapt and respond to environmental change.

1.2 Objective

The objective of my research is to utilize place-based learning methods and cutting-edge mapping technologies with the youth of Fort Albany First Nation, subarctic Ontario, to gauge the potential use of the collaborative-geomatics informatics tool in engaging youth with respect to their community/environment (i.e., culture, history, traditional activities, etc.) and its potential ability to transmit intergenerational knowledge.

1.3 Thesis Structure

This thesis is organized using a manuscript format, containing 5 chapters. Chapter 1 gives a general introduction, providing background information, rationale, and the objective of my research project - while, Chapters 2, 3, and 4 are structured as manuscripts – and Chapter 5 concludes the thesis providing a summary of the main points and future research.

Specifically, Chapter 2 *Examining the Potential Use of the Collaborative-Geomatics Informatics Tool to Foster Intergenerational Transfer of Knowledge in a Remote First Nation Community* discusses using the collaborative-geomatics informatics tool to transfer TEK to First Nation youth and engage them in their local environment (in press, *The Australian Journal of Indigenous Education)*. Chapter 3 *The Collaborative-Geomatics Informatics Tool: Engaging Youth Using Place-Based Education* describes an environmental outreach camp held for youth in the community of Fort Albany, Ontario, with the purpose of bringing awareness and engaging the youth in their local surroundings and environment (2012, *International Journal of Technology, Knowledge and Society* 8:00-00). And Chapter 4 *Sustaining a Local-Food Security Initiative in a Remote Subarctic Community: Engaging Canadian First Nation Youth in Agroforestry-Community Gardens* examines engaging First Nation youth in local food initiatives within their community utilizing place-based education and youth participatory action research methods.

CHAPTER 2: Examining the Potential Use of the Collaborative-Geomatics Informatics Tool to Foster Intergenerational Transfer of Knowledge in a Remote First Nation Community

2.1 Introduction

Each First Nations' community has a unique way of "knowing, learning and teaching traditions" to their youth (McNally, 2004: 604). Historically, this knowledge was generally transmitted orally and by watching and observing (Tsuji, 2000), with many lessons being focused on skills and knowledge that were valuable to surviving in and adapting to the environment (Battiste, 2002; McNally, 2004; Wheaton, 2000). This understanding of the environment allowed First Nations' people to adapt to environmental change (Woodland Heritage Services, 2004). However, socio-cultural changes (e.g., a shift to a wage-based economy) have reduced First Nations' ability to adapt to a changing environment (Berkes et al., 2000; Ford et al., 2008; McDonald et al., 1997; Tsuji & Nieboer, 1999), as there has been disruption in the intergenerational transmission of Indigenous Knowledge (Tsuji, 1996ab). Indeed, residential schooling resulted in a loss of language, culture, and knowledge among the younger generations (Ball, 2004; Ford et al., 2008). In addition, technological changes in field transportation - such as, the use of snow machines and outboard motors (and canvas/fiberglass boats) have decreased the time that family units spend together in the bush – with day and weekend trips by hunters (without their families) becoming more common (Berkes et al., 1995; Cummins, 1992; Tsuji & Nieboer, 1999). As technological changes in transportation have somewhat diminished the family aspect of harvesting activities, similarly there has been a significant reduction in time where Elders and experienced bushmen are connecting with the younger generations in the bush. Thus, technological changes from outside cultures are a contributing factor in the transmissional disruption of Indigenous Knowledge between generations. The loss of knowledge coupled with an accelerated rate of environmental change has made it challenging for northern Indigenous communities to adapt, and has the added potential to increase Indigenous youths' vulnerability to climate change impacts (Ford et al., 2008; Huntington & Fox, 2005).

Postman (1993: 28) uses the term “technocracy” to define society's use of technology to “attack a culture” and/or “control” it, in the name of “development”. The technology becomes a larger part of the culture under pressure causing other aspects, such as, “tradition, social mores, politics, ritual and religion” to be diminished or replaced (Postman, 1993: 28). For northern Canadian Indigenous communities, the attack on their culture came during the colonization of the country, where euro-western culture and lifestyle was forced upon the Indigenous communities, including the technologies that were seen to make the Indigenous societies more “advanced” (Smith, 1999). Recently, there has been a growing amount of community-based research initiated in northern Indigenous communities utilizing western technology in order to address several issues: the growing gap between Elders and youth; the need to collate, store, and transfer Indigenous Knowledge; the need to incorporate Indigenous Knowledge in land use planning; and the need to increase adaptive capacity through the use of Indigenous Knowledge (Baikie et al., 2012; Barbeau et al., 2011; Gardner-Youden et al., 2011b; Pulsifer et al., 2012; Riggs, 2004; Simpson, 2004). Technology is now being used not for assimilation but for cultural preservation, in that the communities have control of and are using technology as tools to aid them in meeting the goals of their community (Dyson, 2003; Gardner-Youden et al., 2011ab; Kral, 2010; Robbins, 2003; Wattchow, 2001). In the present study, the community is a partner in the creation of the technology from the beginning design stages all the way to implementation (Gardner-Youden et al., 2011a; McCarthy et al., 2011).

In an effort to address environmental information management issues (the collection, storage, retrieval and sharing of knowledge, both “western science” and Indigenous Knowledge) with respect to environmental change and to foster adaptive capacity building in the western James Bay region of northern Ontario, Canada, we introduced a potentially useful, web-based, collaborative-geomatics informatics tool. This tool has been field tested in the western James Bay communities and community feedback has been used to modify the tool to the specification of the users (Gardner-Youden et al., 2011a; McCarthy et al., 2011). Once the functionality of the informatics tool is deemed satisfactory by the test community, Indigenous Knowledge collection can begin; however, this does not preclude further modification of the tool if required. It should be emphasized that once the tool has been modified to meet the users’ needs, the informatics tool will be given over as a stand-alone system at no cost to the community, and no further outside access from the researchers to the tool. Nevertheless, the community can request assistance of any type (e.g., technical, system updates) from the researchers with the stand-alone system. This approach has been adopted because access to the Indigenous Knowledge stored on the informatics tool is an intellectual property right issue; thus, the community must have full control over their intellectual property. Even during the formative phase of the informatics tool, security safeguards (e.g., password protection) are used; in other words, access to some types of Indigenous

Knowledge is not open even to the researchers (Gardner-Youden et al., 2011a; McCarthy et al., 2011). As stated by the Fort Albany First Nation Chief (Barbeau et al., 2011: unnumbered). [1]

> *"We want to get to that security, where we feel really comfortable when we get the information…and all this data collection stays in the community…Some place to store that information, as long as it's secure. The other thing is that I think we have to learn how to really progress with the times…making sure that we are very knowledgeable [with respect to all knowledge systems]"*

The collaborative-geomatics informatics tool supports a common reference map based on high-resolution imagery. This tool has real-time capabilities and allows remote communities to monitor and share knowledge (e.g., oral, written and visual [photographs and videos]) and work in collaboration with specified groups, in a secure system with accessibility safeguards. During community testing of the viability of the collaborative-geomatics informatics tool in Fort Albany First Nation, community members commented that the collaborative informatics tool may also be a useful tool to help foster intergenerational transfer of Indigenous Knowledge and have youth become more aware of their land:

> *"I can see this [collaborative-geomatics informatics tool] being used by the students of the school… where things are…family relationships… [students] love taking pictures… [Students could record] the [river-ice] break up dates… the amount of snowfall, mean temperatures or daily temperatures… it's a good project for students… It is what the elders used to do anyway, keep track of*

everything… transferring everything into the [collaborative geomatics] library and that's where we find all this stuff. Animal names, vegetation names… where certain types of animal are… to be aware of [what] the land looks like" (Participant 10, as cited in Barbeau et al., 2011: 121).

"*It would be good, for the new generation that's coming up. They'll know what's going on, and it would be handy like, be good for the schools…So they [schoolchildren] will know their ancestors and their culture, fishing, trapping, the land, everything. It would be great…they are into this… Internet thing. This is good, really good…they would know more about their land…the history…*" (Participant 7)

"*It…would benefit a lot if it [the collaborative-geomatics informatics tool] was programmed in the school, like for the kids to learn…it would encourage them to go out…*" (Participant 5)

"*History of our land, I know I have a lot of ideas. I don't go out in the bush a lot [now], but I think this will [help preserve our] …history…what we went through when we were young…for the kids now. It's very different from way back. I find there's a lot of changes and it's good for a system like [the collaborative-geomatics informatics tool]…to be in place…or even getting the elders to teach you how to do this sort of stuff. I mean how to trap beavers [and you could video tape that] and then put it on there*" (Participant 9)

"*Beats a textbook for sure*" (Participant 6)

Elders also commented on the tool's potential to be used in the community:

> "*Yeah it's simple enough. Like I would have to adapt to it like, like anything. You try something new, you have to get used to it first, before you can use it*" (Participant 1)

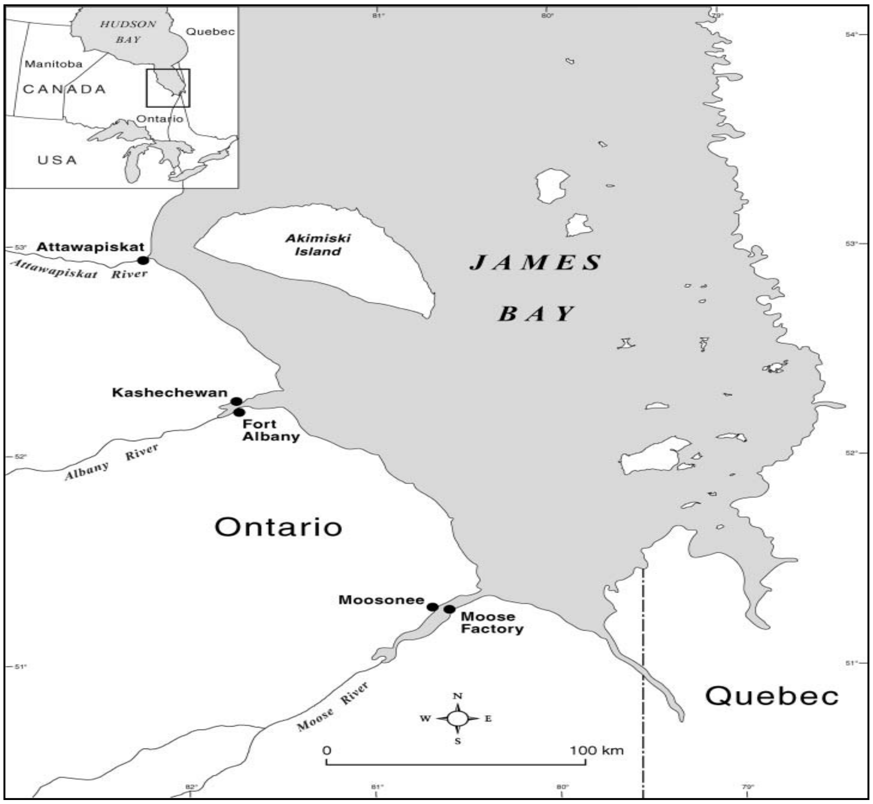
> "*First time you're mesmerized by the buttons, by the squares by the lingo that you use...the poly line, for me I don't know what a poly line is. Until you click it…then I see you can understand what a poly line is, terminology, we'll get used to that*" (Participant 10)

In this pilot study, we continue to assess the potential of the collaborative-geomatics informatics tool by examining its capacity to connect today's youth with bushmen, Elders, and the land - allowing for intergenerational knowledge transfer - in an effort to rebuild adaptive capacity in Fort Albany First Nation. Our research team has been involved in community-based participatory research with Fort Albany First Nation for over twenty-five years[2], and the present initiative is an extension of this partnership.

2.2 Methods

2.2.1 Study Area

Figure 1: Map of the Mushkegowuk Territory in western James Bay, Ontario, Canada



Fort Albany First Nation is located in northern Ontario, Canada. The community proper is located on Sinclair Island in the Albany River, with people also living on the mainland and nearby Anderson Island; the population is approximately 850 people (Tsuji, 1996a) (see Figure 1). Being a remote community, it is only accessible year-round by airplane; while, in the winter months a snow-ice road connects Fort Albany First Nation to the other coastal James Bay First Nations and the community of Moosonee (where there is rail service). During the ice-free seasons, barge transportation is available from Moosonee to the coastal First Nations. Education is provided to the youth of Fort Albany at Peetabeck Academy, which is under the control of the Mundo Peetabeck Education Authority (a First Nation-administered organization similar in function to a Board of Education). The school contains facilities to educate children from pre-kindergarten to grade 12, following the Ontario curriculum. However, Cree language classes are also part of the curriculum and various cultural activities also occur throughout the school year.

2.2.2 Community-Based Participatory Research

Guided by community-based participatory research methods, the initial need for an informatics tool was brought forward from the community, and the iterative design of the informatics tool was a partnership exercise between community members (e.g., the Band Council, the locally elected government of the First Nation; land use planning staff; health services personnel; Education Authority personnel) and the research team (Castelden et al., 2008; Gardner-Youden et al., 2011a; McCarthy et al., 2011). Semi-directive interviews and focus groups were conducted with community members to determine the suitability of the informatics tool – at this stage it could have been rejected outright – and an alternative informatics tool would have to have been developed or bought (McCarthy et al., 2011). As the collaborative-geomatics informatics tool was found to be suitable for the needs of the community, recommendations for modifications of the tool (informed by the semi-directive interviews and focus groups) were brought back to the Computer Systems Group at the University of Waterloo (Barbeau et al., 2011; McCarthy et al., 2011). This iterative process of "acting, observing and reflecting" is an important part of participatory research (Kemmis & McTaggart, 2005, pp. 596). The development and customization of the informatics system itself is meant to support a collaborative process throughout, rather than during just the initial planning stage which is often seen in “conventional software design” (Barbeau et al., 2011; Gardner-Youden, 2011a; McCarthy et al., 2011: 310). The community members are more than just participants in the research, in that they help to guide/facilitate the research process and there are direct benefits from the research for them, rather than just for the outside researchers (Berg, 2004: 196). The present project continues the process of participatory research by engaging the youth in utilizing the tool and gaining their perspectives on it, in order to further assess the tool to make any necessary changes (Berg, 2004).

2.2.3 Collaborative-Geomatics Informatics Tool

The collaborative-geomatics informatics tool enables “a participatory approach to both the development and use of online, distributed-authority, geomatics applications” (McCarthy et al., 2011: 310). Geomatics focuses on organizing “geographically referenced data, visualization of data on maps and graphs, and the spatial analysis of data” (Cusimano et al., 2007: 51). Our tool is similar to GIS as it is also a mapping tool; what makes this tool unique from other GIS technologies is the Web Informatics Development Environment (WIDE) toolkit that allows for a forms-based (or wizards-based) approach[3] to system construction that supports the rapid development and modification of the system (Cowan et al., 2006; McCarthy et al., 2011). Thus, the WIDE toolkit allows for greater community engagement by supporting the relatively rapid customization of each collaborative-geomatics informatics tool, being informed by community input in a relatively short period of time (Cowan et al., 2006; Gardner-Youden, 2011a; McCarthy et al., 2011). The WIDE toolkit was developed by the Computer Systems Group of the University of Waterloo; the toolkit supports the collection, collation and presentation of geo-spatial data (including GIS) on high resolution satellite imagery using a collaborative social network (Cowan et al., 2006; McCarthy et al., 2011). Our informatics tool is similar to Public Participation/Participatory GIS, as our tool focuses on including a more public audience, collaboration between users and groups of people and a wider distribution of data (McCarthy et al., 2011). Due to being entirely web-based, the cost of the collaborative-geomatics informatics tool is significantly lower compared to other GIS software. It was specifically designed to be user friendly and can be used by most people with a short lesson (McCarthy et al., 2011).

2.2.4 Educational Approach

The cultural discontinuity hypothesis suggests that when the classroom environment is incongruent with the home environment or past experiences, there is limited opportunity to engage Indigenous children in the learning process (Rohner, 1965). Adding to this issue, there is an ambiguity associated with identifying what are Indigenous learning styles, as there are almost 150 different First Nations in Ontario alone. Nonetheless, we need a starting point from which to design an educational environment that is conducive to engaging Indigenous children in the learning process. Thus, we have identified from the published literature educational strategies that tend to result in greater Indigenous student success in North America (see Table 1). With our outreach program, we have employed all the educational strategies in Table 1, in an effort to more fully engage the youth.

2.2.5 Our Environmental Outreach Program

Our research team in partnership with the Mundo Peetabeck Education Authority has held a community-based, environmental-science outreach camp in Fort Albany over the past eight years. The camp connected youth with environmental science and technology mentors and contextualized all activities to sub-arctic Ontario. Activities highlighted environmental concerns related to environmental change; these concerns were raised by community members (e.g., shoreline changes) (Karagatzides et al., 2011). Through consultation with the community, the program was developed for students in grades 6-8, with a focus of getting them interested in environmental science and technology as a possible post-secondary education path (Karagatzides et al., 2011: 204). Students were taken out on the land by environmental studies/sciences professors, graduate students, and experienced bushmen. They participated in activities, such as, studying carnivorous pitcher plants and the impacts of contaminants on these plants, as well as searching for fossils, and discussing why marine fossils are now found in freshwater areas and on land (the answer is due to post-glacial isostatic rebound; Karagatzides et al., 2011). Many youth looked forward to participating in the camp, as those who participated in the camp in previous years have many positive memories and often come back.

In continuing partnership with the community, the potential use of the collaborative-geomatics informatics tool by youth was examined at a summer outreach camp. The outreach camp was used to introduce the informatics tool to youth of Peetabeck Academy entering grades 6-8 (in the 2011 school year), during a 5-day camp in late July, 2011. Community members were recruited to help facilitate activities in the camp and play an active role in transferring knowledge and information about the land and environment to the youth. Participating members were chosen based on their extensive knowledge of traditional activities in the surrounding area and had full control over how the activities were executed (Berg, 2004; Kemmis & McTaggart, 2005). Only 10 children were recruited for this camp, as we wanted a small group to optimize the mentoring experience with community "bushmen" and the Elder (Blatchford et al., 2005; Karagatzides et al., 2011). In our previous community-based, environmental outreach camps, it was found that informal educational settings, activities that relied on spatial/visual cues, collaborative activities in small groups, and hands-on and experiential teaching contextualized to the community and surrounding environment (e.g., the wetlands of the James Bay coast) were most effective in engaging the schoolchildren (Karagatzides et al., 2011). The use of these types of educational strategies among First Nation youth have been reported to be culturally appropriate (Battiste, 2002; Biermann, 2008; Maina, 1997; McNally, 2004; More, 1987; Wheaton, 2000; see Table 1). These educational strategies as well as the others described in Table 1 were used for the present outreach initiative; however, conducive to our approach, we were prepared to adapt the program as needed to ensure that it was meeting the youths' needs and abilities (Berg, 2004; Kemmis & McTaggart, 2005: 563).

The outreach program gave students the opportunity to interact with the collaborative-geomatics informatics tool, while participating in traditional activities. For example, one activity centered around the harvesting of whitefish (*Coregonus* spp.) from the Albany River. The children were paired with camp leaders (e.g., professors, graduate students, or the one high school student from Peetabeck Academy who had participated for three years in our previous environmental camps) and one of four experienced bushmen. As the Albany River was particularly dry during the summer of 2011, river-water levels were a determining factor on when river travel was safe, especially taking into account the daily tides. When on the river, the children helped the four bushmen set nets and check them the following day for fish. Any fish caught were taken to the Elder who showed them how to clean and smoke the fish. The children were able to taste the fish that they helped harvest and smoke. Hikes around the community were another important activity, as they allowed students to share the knowledge they had gained from their parents/Elders/others about their community. For example, several trails were explored around the community where students (and camp leaders) identified and consumed the various edible berries (e.g., strawberries, *Fragaria* spp. and raspberries, *Rubus* spp.) and interesting plants (e.g., Labrador tea, *Rhododendron* spp.).

2.2.6 Global Positioning System

The Garmin Oregon 550 GPS was chosen due to its user-friendly interface, durability, and most importantly, its ability to take geo-tagged photographs (i.e., longitudinal and latitudinal coordinates were associated with each photograph taken). In educational venues, various GIS (Geographical Information System) software and handheld devices are being introduced as a way to enhance learning for students, by having them explore their community and apply skills from the classroom into the real world (Broda and Baxter, 2002; Christie, 2007; Churchill et al., 2010; Sugimoto et al., 2006). GIS software acts as a tool that allows users to create maps that display and analyze data, such as, watersheds, utilizing various geographical scales (Cusimano et al., 2007). In many First Nations communities, GIS software is integral for documenting traditional lands and activities for planning and development purposes (Chapin et al., 2005; Tobias, 2000). However, these GIS systems are often expensive to purchase and require “experts” to fully utilize them (Gardner-Youden et al., 2011ab; McCarthy et al., 2011).

The GPS devices were used as a tool for youth to further explore their community and record their activities. Each day the youth used the camera on the GPS to record all their interactions with the land and activities, in the form of photographs; their pictures were then transferred by the students (with help from the camp leaders after a demonstration) into the collaborative-geomatics informatics tool. Prior to the loading of their photographs, each student created an account with the help of a camp leader. The students were then shown how to use the collaborative-geomatics informatics tool through a hands-on demonstration. The lesson went over how to use the online tools (e.g., map tools: zooming in and out, viewing photographs, videos and using audio), uploading and viewing data. With some help from camp leaders, the students used their global positioning system (GPS) devices to upload one of their favourite geo-tagged photographs to the informatics tool. The students were then able to see spatially on the high-resolution satellite imagery map where they had taken that photograph and relate it back to the experience they had.

The GPS device was also used to develop and apply students’ orienteering skills through activities, such as, geocaching. Geocaching is a game requiring the use of a compass and map to locate “treasures”, in this case, Indigenous knowledge.

2.2.7 Evaluation

A qualitative mixed method design (a combination of field notes, participant observation, photographs and semi-directed student interviews) was used to explore the potential utility of using the collaborative-geomatics informatics tool, as an adjunctive tool, for the transmission of Indigenous knowledge (Barbeau et al., 2011; Bryman, 2001; Churchill et al., 2010; Heath & Walker, 2012). We use the word adjunctive, as the informatics tool is meant to complement the Indigenous knowledge transference system, not replace it. All students present on the last day of camp were asked general questions to encourage discussion about the program and the collaborative-geomatics informatics tool.

Questions on whether the youth enjoyed participating in the camp, provided insight on what activities they enjoyed and what they had learned about. Further questions regarding using the GPS devices, the collaborative-geomatics informatics tool and if they were simple to use and understand, provided initial information on whether the system had the potential to be used by youth to connect with the land. Interviews were transcribed verbatim and analyzed using both deductive and inductive thematic coding by the primary author (ADI) and confirmed by one of the co-authors (LJST).

2.3 Results and Discussion

2.3.1 GPS Devices

Overall students quickly learned to use the GPS devices and enjoyed using them. When youth were asked what they liked about using the GPS devices, two themes emerged from their responses: 1. the use of the camera and 2. using the GPS to geocache.

1. Use of the Camera

> *"[I liked] taking pictures of what we found and what we looked at [and] where we went"* (Participant #3)

The process of taking photographs while out on the land and uploading them to the collaborative-geomatics informatics tool allowed youth to connect with the land and community members. In this way, the youth directly gained knowledge about their culture and community (transfer of intergenerational knowledge); while also indirectly contributing to the storage and transfer of knowledge to other community members (Wang & Burris, 1997; Wang et al., 2004).

2. Geocaching

> *"…going scavenger hunting [geocaching] those treasure thingies [geocaches]… using the GPS… going in the bush looking for them [geocaches]…that was kind of fun…"*(Participant #1)

When introducing the geocaching activity many of the youth mentioned that they had learned about maps and longitude and latitude in class, the use of the GPS devices allowed them to directly apply this knowledge in a real-life situation (Broda & Baxter, 2002; Sugimoto et al., 2006;). Many First Nation communities across Canada are using maps and mapping technology to record information about traditional lands, hunting grounds, and abiotic and biotic features of cultural significance, in order to protect their land and resources as well as prepare for the growing amount of development planned for Canada's north (Chapin et al., 2005; Gardner-Youden, 2011a; McDonald et al., 1997; Pulsifer et al., 2012; Simms, 2010). The skills used by the youth in the activities are important for ensuring that First Nation communities are able to continue to adapt to the changes occurring in and around their community, while protecting their culture and land (Chapin et al., 2005; Tobias, 2000; Turner, 2005). Having more community members with the skills to utilize technologies, such as, the collaborative-geomatics informatics tool and GPS devices reduces the need for outside "experts". Building up capacity of this type gives the community greater control over how the data are collected, processed and interpreted, which is a growing concern for many First Nation communities who are dealing with resource development issues (McCarthy et al., 2011; Tobias, 2000; Youden-Gardener, 2010).

2.3.2 The Collaborative-Geomatics Informatics Tool

Most students were able to use the informatics tool on their own, after a short lesson. When asked about the ease of using the informatics tool, students were split in their opinion, some finding it relatively difficult, other students finding it very easy to use. Difficulty with the tool seemed to arise from the layout of the tool and navigating through the system.

> *"It had all these stuff [pages] coming up and using a lot of things [having to navigate a lot]"* (Participant #3).

There were enough camp leaders available to help students navigate through the system and answer any questions they had regarding the use of the tool. The youth had a difficult time explaining in the interview why they found the system hard to use; however, comments during the use of the tool were noted during participant observation. For example, the process for signing up for an account and uploading photographs took too long and students grew impatient filling in the required sections. These issues were brought up with the Computer Systems Group at the University of Waterloo and have been rectified and successfully field-tested with the youth at a subsequent outreach camp.

When the students were introduced to the collaborative-geomatics informatics tool they were shown how to use it and were given a chance to explore it, by locating their community, uploading photographs and then viewing each other’s photographs and other data uploaded to the system (e.g., videos, articles) (Figure 2, 3, 4).

Figure 2: Screenshot of the collaborative-geomatics informatics tool, displaying a photograph taken by a student of where strawberries can be found.

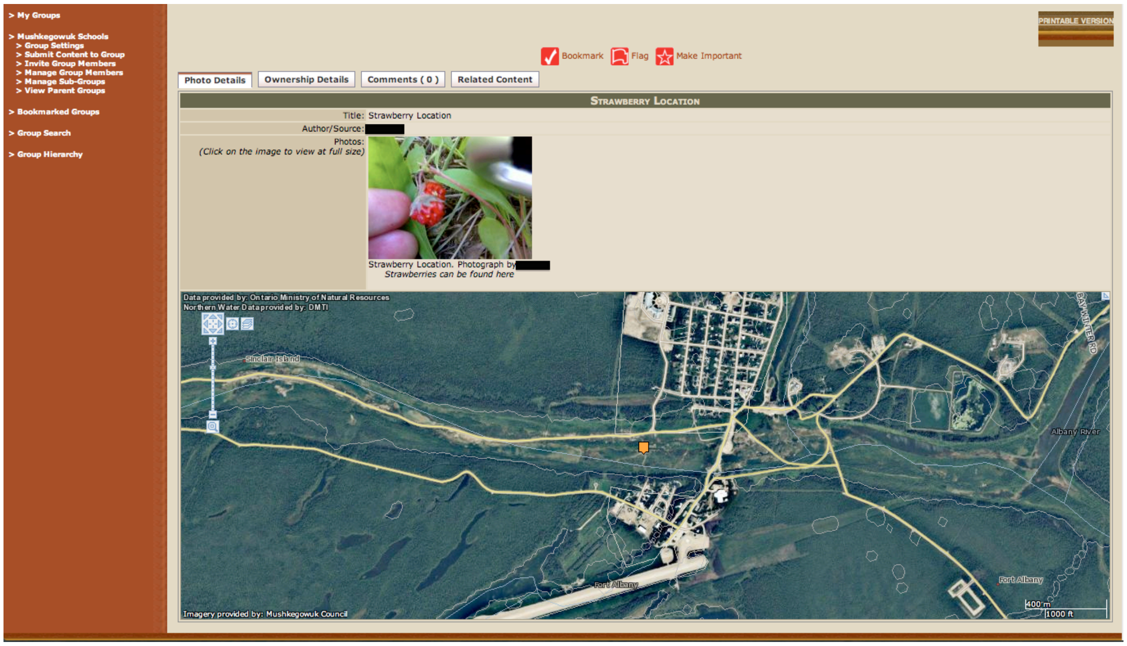


Figure 3: Screenshot of the collaborative-geomatics informatics tool, displaying a photograph taken by a student of the bog they visited during the camp.

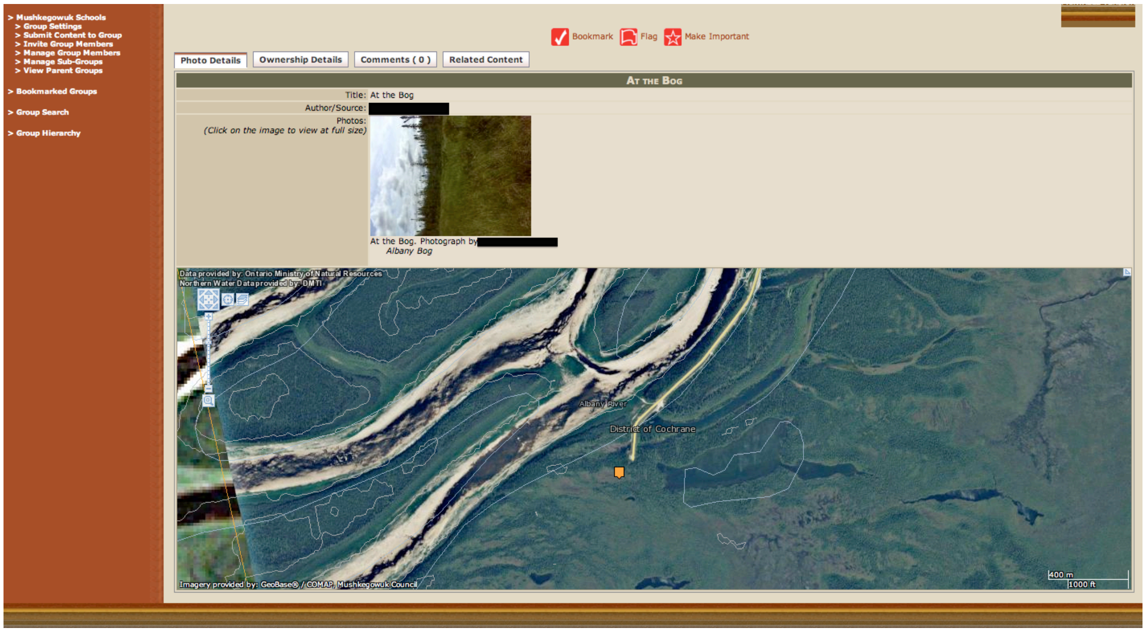
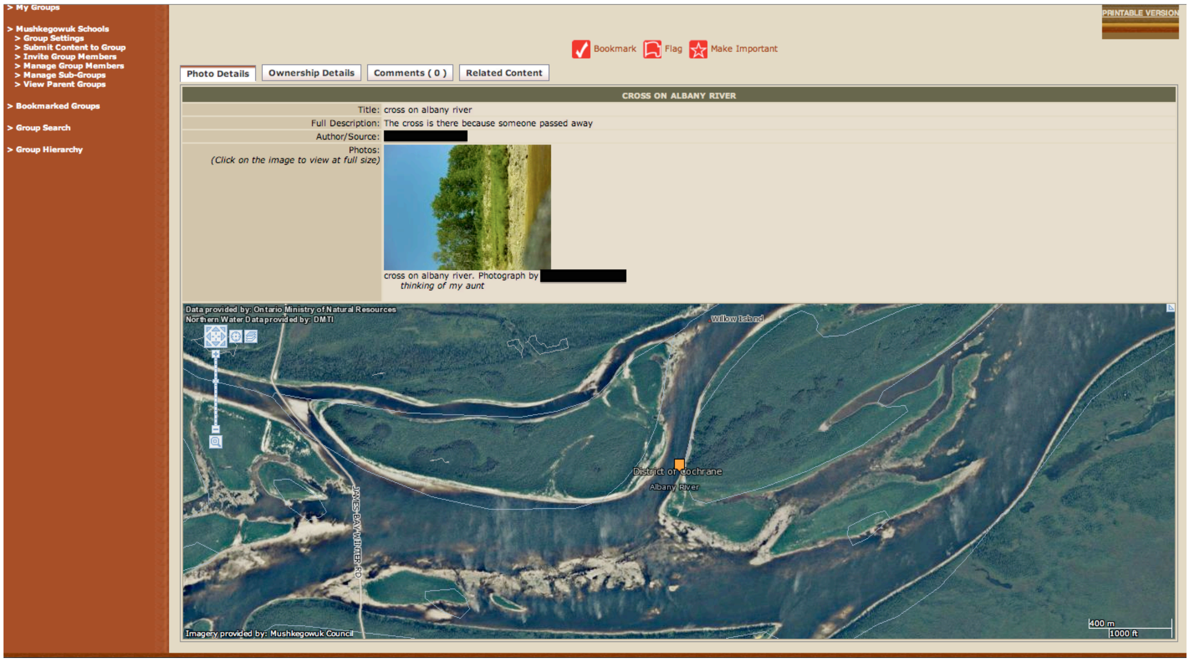


Figure 4: Screenshot of the collaborative-geomatics informatics tool, displaying a photograph taken by a student during a boat ride along the Albany River.



When asked for what purposes they would use the system for, answers centered on using the informatics tool for traditional activities, such as, hunting and fishing:

> *"To look up where you can like [go]… hunting…I would look on that thing [collaborative-geomatics informatics tool] and someone might have marked it [hunting area] somewhere and you can go back over there and go hunt over there"* (Participant #1).
>
> *"Finding a spot to go fishing or something"* (Participant #3).
>
> *"Look for whitefish"* (Participant #1).

The youth were able to see the tool's potential in connecting them to the land and associated traditional activities. The tool allowed the youth to come into the activities with knowledge and skills that they were strong in (using technology) and share this knowledge with the bushmen, while also learning about the traditional activities and knowledge of the area (Kral, 2010). Cultural activities such as hunting and fishing are an important part of the Cree culture in Fort Albany; participating in these activities allowed youth to gain knowledge from community members about the surrounding environment, history and methods they currently use in order to sustain their land and resources (e.g., hunting certain animals during specific seasons in order to ensure the population can sustain itself) (Tsuji, 1996a; Tsuji & Nieboer, 1999). This knowledge is very important for cultural sustainability, but also for the community's future ability to adapt to the changes and challenges predicted for Canada's north (Ford et al., 2008; Huntington & Fox, 2005; McDonald et al., 1997). The youths' ability to use the technology with very little training in order to document the places they visited further supports the findings by Barbeau et al., (2011) that the collaborative-geomatics tool has the potential for the youth (and in general, the community at large) to learn to use this western technology and use it in a way that is beneficial to them (Aikenhead, 1997; Simms, 2010; Tobias, 2000).

During the interview and use of the informatics tool, the students made positive comments about the system's ability to upload and share the photographs they had taken and view each other's photographs (see Figure 2, 3, 4). The students enjoyed navigating through the map to view each photograph uploaded and sharing stories or experiences with locations they visited (Broda & Baxter, 2002; Okada et al., 2002).

> *"The bog [was one of my favourite places I visited]. It's quite an experience learning. [I liked] learning about plants. [I liked] to look at the places where I*

took pictures of…the pitcher plant [Sarracenia purpurea]…[at the] end of the dikes and you go to that trail and…you end up [in the bog].” (Participant #4)

“[I liked]…how it [the collaborative-geomatics informatics tool] showed you where you took the picture.” (Participant #2)

“The bog [was one of my favourite places I visited]…cause you can find those pitcher plants…No [I had never been there before and I did not know that the bog existed]…[I also liked]…looking at the Albany River and looking where we were at or where we went and posting that… horse [a piece of wood that looked like a horse] picture.” (Participant #3)

The geospatial-visual aspect of the system really appealed to the students, which is what the community members had initially predicted (Barbeau et al., 2011). The visual support provided by the technologies created a bridge between the youth and the land by allowing them to learn about the land, even when not on it, through the uploaded data on the informatics tool.

2.3.3 The Environmental Outreach Program

Nothing can (or should) replace the actual contextualization of hands-on lessons in the bush, which is why it was important to include these activities in the outreach program with the collaborative-geomatics informatics tool (Lertzman, 2002; Smith. 2002; Tafoya, 1995; Tsuji, 2000; Turner, 2005). The use of the technologies with the traditional activities provided students’ with a practical example of how the technology and activities can be used in real life situations and how western technology can be used with Indigenous culture in a complementary way (Aikenhead, 1997; Dyson, 2003; Kral, 2010; Robbins, 2003; Wattchow, 2001).

When the students were asked about their favourite activities they had participated in and places they had visited during the camp, they all mentioned the boating activities on the Albany River with the bushmen. On these trips, students were taught the following by the bushmen: what time of season that you put the nets out, as whitefish are only plentiful during certain times of the year; what time of day you take the boats out to set the nets, and what time of day you check the nets, as the tides have to be accounted for; the importance of the location of the nets; how to set the nets; how to check the nets; and the different species of fish that are in the Albany River. Students were also shown how to clean and smoke the fish they had harvested by a community Elder, who also narrated the process in the Cree language. The hikes around the community where students were shown culturally interesting areas, flora and fauna, provided contextualized lessons in traditional food foraging and connected well with the traditional activity of harvesting of fish. The skills and knowledge associated with foraging, fishing and even orienteering are all traditional activities that have been handed down for generations and have been a part of the First Nations' ability to adapt to their dynamic environment (McDonald et al., 1997; Simms, 2010; Tsuji & Nieboer, 1999).

Some of these lessons were oral, some were through observation, some were by actually doing the activity, and others were a combination of all of the above. It was important that the youth participated in these activities for multiple reasons; one of them being that many youth do not have the opportunity to participate in traditional activities on a regular basis or at all due to the cost to the family and/or the lack of knowledge (Tsuji & Nieboer, 1999). Second, it was integral that the community was a key part of the program, because cultural information should ideally be taught by the holders of that knowledge either directly and/or remotely (e.g., video) (Dold & Chapman, 2011; Kemmis & McTaggart, 2005; Smith, 2002). Finally, the activities engaged in during the present initiative allowed the youth to see how technology can be used out on the land for various purposes and in a manner that was beneficial to their community and culture (Aikenhead, 1997; Castleden et al., 2008; Ngai & Keohn, 2010; Okada et al., 2002; Riggs, 2004).

2.4 Conclusion

The outreach program worked well in connecting youth with knowledgeable community members allowing for the direct transfer of traditional knowledge in a culturally appropriate manner, that is, learning through observation and doing, as well as other culturally-appropriate educational strategies (see Table 1). In addition, the informatics tool supported the archiving of this knowledge through the uploading of geospatially tagged pictures taken by the youth (see Figure 2, 3, 4), and uploading of associated video clips (e.g., an Elder smoking of fish with instructions in Cree). In this way, camp experiences were stored for later viewing and/or shared with other youth (and other community members) who were not present at the camp; that is, the informatics tool has the ability to facilitate indirect transfer of traditional knowledge. This route of transmission needs to be explored further, because even though youth have good technological skills and can see the potential of the informatics tool, it does not mean they will actually use the informatics tool for this purpose. Thus, future research will assess what methods should be used to further engage youth in using the collaborative-geomatics informatics tool; a fall 2011 afterschool program with 10 schoolchildren and a summer 2012 program with 15 youth in Fort Albany have been completed and more outreach programs are being planned.

Notes

[1] These unpublished quotes originated from semi-directive interviews with community members of Fort Albany First Nation, as detailed in Barbeau et al., (2011).

[2] Research with the community has been varied (e.g., environmental contaminants, Tsuji et al., 2006; Tsuji et al., 2009; nutrition, Gates et al., 2011; environmental impact assessment Whitelaw et al., 2009).

[3] The WIDE toolkit was developed to remove the need for outside "gate keepers" such as programmers and GIS technicians. This allows community members to have greater control of their data, from collection to management. The wizard or forms-based approach decreases the complexity of a task by dividing it up into smaller steps, allowing "the technical team to develop web-based information systems faster than more traditional methods" (McCarthy et al., 2011: 310). This approach promotes collaboration with the users, as they are involved during the entire creation of the system from design to implementation. This differs from conventional methods where systems are created with very little input from the user and often need to be redesigned to meet their needs (McCarthy et al., 2011: 310).

Table 1: Educational strategies shown to have a positive impact on the academic performance of North American Indigenous students (modified from Karagatzides et al., 2011).

- showing respect for Indigenous culture
- sharing classroom control and responsibility
- empowering of students through self-directed learning
- the use of informal educational settings
- the use of resources that rely on spatial/visual cues
- educators acting as guides/facilitators
- the use of group activities
- stressing of collaborative learning rather than competitive
- peer teaching and learning
- elaboration of knowledge at the time of acquisition through discussion
- providing time for private practice and reflection
- holistic methods
- the use of hands-on and experiential teaching
- the use of relevant resource material
- decreasing the amount of formal lecturing time
- the use of non-threatening evaluations
- avoid "spotlighting"
- the use of multimodal instruction
- the stressing of skill development

Sources: Dumont, 1972; Miller & Thomas, 1972; Leith & Slentz, 1984; Pepper & Henry, 1986; More, 1987; Rhodes, 1988; Foreman, 1991; Sawyer, 1991; Feurer, 1993; Irwin & Reynolds, 1992; Wilson, 1992; Wilgosh & Mulcahy, 1993; Dick, Estell & McCarty, 1994; Zwick & Miller, 1996; Wright, 1998

CHAPTER 3: The Collaborative-Geomatics Informatics Tool: Engaging Youth Using Place-Based Education

3.1 Introduction

In Canada, Aboriginal[1] mapping has been used since the 1950s, to document land use and occupancy information for a variety of purposes (e.g., land claims, environmental impact assessments, preserving traditional environmental knowledge[2] [TEK]; Chapin et al., 2005). Thus, the ability of Aboriginal communities to collect, collate, analyze, present, and store their data is of great importance (Tobias, 2000). The use of mapping by Aboriginal communities continues to grow as mapping technologies, such as, Geographical Information Systems[3] (GIS) or other geospatially-based systems (e.g., collaborative-geomatics[4]) have become more accessible (Simms, 2010; Chapin et al., 2005).

Collaborative-geomatics is a participatory approach "to both the development and use of online, distributed-authority, geomatics applications" (McCarthy et al., 2011: 310). Our collaborative-geomatics informatics tool is unique compared to other participatory, geospatially-based systems, as we use the Web Informatics Development Environment (WIDE) toolkit (McCarthy et al., 2011; Cowan et al., 2006). The WIDE toolkit was developed by the Computer Systems Group of the University of Waterloo and utilizes a wizards-based (or forms-based) approach to system construction; that is, the toolkit allows for the relatively rapid development and modification of the system (McCarthy et al., 2011; Cowan et al., 2006). Thus, the WIDE toolkit facilitates greater community engagement by supporting relatively quick customization of each collaborative-geomatics informatics tool, after community input (McCarthy et al., 2011; Gardner-Youden et al., 2011b). The WIDE toolkit also supports collaboration within as well as between communities using its social networking feature, requires minimal expertise to use with no installation (as it is online), and is relatively inexpensive (McCarthy et al., 2011). The WIDE toolkit removes the need for gate keepers (e.g., programmers and GIS technicians) allowing communities to take control of the collection, collation, processing, and management of their own information (McCarthy et al., 2011).

However, an issue exists as with other mapping technologies, the use of collaborative-geomatics informatics tool has been utilized with only one segment of the Aboriginal population in mind, adults; thus, for continuity purposes, there is a need to engage the Aboriginal youth (Dyson, 2003; Darbyshire et al., 2005). Indeed, community members of the remote First Nations we work with have stressed the need for their youth to also be able to use the collaborative-goematics informatics tool to help ensure the sustainability of the tool as an information management system for future planning activities, as well as a vehicle for youth to learn more about their community and surrounding environment[5] (Barbeau et al., 2011; McCarthy et al., 2011; Kral, 2010). In this paper, we describe a pilot study that examines if place-based education can be used to engage First Nation youth with respect to use of the collaborative-geomatics informatics tool.

3.2 Methods

3.2.1 Study Area

The study community is located in northern Ontario, Canada, on the west coast of James Bay. Fort Albany First Nation is a remote sub-arctic community located on Sinclair Island in the Albany River, with some residents also living on the mainland and nearby Anderson Island (Tsuji, 1996b). The community is accessible only by plane year round. In Fort Albany, the Mundo Peetabeck Education Authority is the First Nation-administered school board. Peetabeck Academy is a First Nation-administered school and provides education for grades pre-kindergarten to grade 12, utilizing the Ontario curriculum.

3.2.2 Environmental Outreach

Introduction to, and familiarization with, the collaborative-geomatics informatics tool was facilitated through two environmental outreach camps; one in July 2011, and the other in October 2011. A local community member recruited students in grades 6-9 from Peetabeck Academy to participate in the initiative. The maximum number of students recruited to participate was capped at ten; this was to done to ensure more one-on-one mentoring activities, as learning through mentoring is culturally-appropriate for First Nations people (Wheaton, 2000; Battiste, 2002; Maina, 1997). The teaching methods used for the outreach program also looked to include practices that were traditionally used with youth to teach tasks, stories or community principles in First Nation communities (Battiste, 2002; Wheaton, 2000; Saunders & Hill, 2007; Stairs, 1995). For the July camp, a total of eight students returned consent forms to participate; actual participation rates varied by day, but were typically five to six students. Eleven consent forms were returned by students for the October camp, with eight to ten students participating dependent on the day. Previous camps revealed the importance of using an informal place-based educational format in Fort Albany (Karagatzides et al., 2011), as this format provides youth with the opportunity to learn about and interact with their community and surrounding environment (Biermann, 2008, Gruenewald, 2003; Sobel, 2008). Outdoor place-based education provides students with the opportunity to create opinions and apply critical thinking, while building a connection between the school and community which is often lost in the conventional classroom (Okada et al., 2002: 52; Sobel, 2008; Gruenewald, 2003). The present program focused on transmitting knowledge of the environment through various activities in and around the community. The place-based educational method complements culturally-appropriate teaching methods, such as, experiential learning, collaborative group work, and mentoring, all of which have also been shown to improve Aboriginal student success (Battiste, 2002; Wheaton, 2000; Maina, 1997; McNally, 2004; More, 1987, Lertzman, 2002).

3.2.3 Program Activities

The two camps provided students with the opportunity to directly interact with their environment through a range of outdoor, place-based education activities, as well as indirectly through the use of the collaborative-geomatics informatics tool. During the July camp, carnivorous pitcher plants (*Sarracenia purpurea)* found inhabiting a bog near the community were used as a model to show students the impact of pollution (i.e., acid rain in this case) on the environment. The students examined the pitcher plants and were informed how areas of high nitrogen impact the pitcher plant resulting in morphological changes; it was explained that these plants become non-carnivorous and must rely on photosynthesis (Karagatzides et al., 2011). This activity provided a place-based example illustrating how human activity may have a negative impact on the environment.

In addition, paleozoic fossil localities were prospected during the July camp, on natural outcrops along the Albany River near the community, and also in quarry sites used for gravel production. Marine fossils of the region provided the impetus for discussing environmental change, as the region around Fort Albany was once covered by a large inland sea although only fresh water is currently found nearby. It was explained that post-glacial isostatic rebound[6] was the reason why marine fossils were found so far inland (Karagatzides et al., 2011).

In order to connect the place-based education activities, which took place out in the community, to the collaborative-geomatics informatics tool on a computer, handheld global positioning systems (GPS) were used. The Garmin Oregon 550 GPS model was chosen due to its user-friendly interface, which is very similar to other handheld devices with touch screens, and made it user-friendly for students who had experience with touchscreen devices. In addition, the Oregon 550 model included a built in camera that allowed students to take pictures and have the geographical information automatically connected to the photographs. This allowed for easy transfer of visual and place-based information to the collaborative-geomatics informatics tool. Many schools are beginning to realize the benefits of utilizing place-based information on electronic devices, such as, the GPS to enhance learning for students by providing an outlet for students to apply what they have learned in the classroom to the real world (Churchill et al., 2010; Broda & Baxter, 2002; Sugimoto et al., 2006).

Geocaching, a game where individuals use a GPS to find hidden "treasures" left by other geocachers (Christie, 2007), was also utilized during the July camp. The activity required students to use the GPS map and compass to find six hidden geocached treasures (these treasures were candy and small toys); each treasure was located at a certain type of tree with an information card attached that provided interesting information about that species of tree (e.g., White Birch, *Betula papyrifera,* is used as a fire starter). This activity required students to become comfortable with using the GPS technology, as well as apply their newly developed orienteering skills to find their way around the forested area.

During the October camp, the students again used the GPS devices to navigate in an "Amazing Race" style game (Trimpe, 2006). A total of 10 challenges were set up across the community; the students were given a set of coordinates to input into the GPS to find the location of each challenge (Trimpe, 2006). At each location the students were required to complete a task often requiring them to utilize different aspects of the GPS, such as, the camera or compass (Trimpe, 2006). The students again uploaded their geo-tagged pictures and other information. The collaborative-geomatics informatics tool allowed for the collation, sharing and storing of place-based information collected by the students; the tool allowed for real-life experiences to be reflected upon at a later date and stored in a variety of media (i.e., audio, video and photographic).

3.2.4 Evaluation

Qualitative methods (i.e., semi-directed interviews, participant observation and field notes) were utilized to gauge if place-based education can be used to engage First

Nation youth with respect to use of the collaborative-geomatics informatics tool. Students present on the final day of each camp were interviewed and probes were used to encourage discussion following Skinner et al., (2006). At the end of the July camp students were interviewed individually; while, during the October camp students were interviewed in the pairs they had worked together in throughout the camp and when using the collaborative-geomatics informatics tool (Hanna et al., 2004). Semi-directed interviews have been shown to be an effective method in eliciting responses with students, as it mimics more of a conversation style and allows students to speak more openly than with a structured interview (Skinner et al., 2006; Churchill et al., 2010). Field notes and participant observations provided further insight into how students perceived the program, as well as the collaborative-geomatics informatics tool (Churchill et al., 2010, Bryman, 2001). Interviews were transcribed verbatim and coded using thematic analyses (Bryman, 2001).

3.3 Results and Discussion

3.3.1 Environmental Outreach

The place-based education format was used as it served to meet the need of community members to get students involved and interested in the community and surrounding environment. Both camps provided students with the opportunity to explore and learn about various areas and aspects of their community (Biermann, 2008, Gruenewald, 2003; Sobel & Spikol, 1999). Students' responses showed that they enjoyed the community-based activities associated with the program:

"[I liked] how it [the program] was all around… all over the community." (Participant #6)

"[My favourite activity was] probably doing that Tamarack tree one… cause I like… looking at trees and looking at the Labrador tea leaves." (Participant #6)

Although most students were familiar with the locations of the activities (e.g., the youth site, the dike), they still displayed great interest and enthusiasm for visiting them and participating in the associated activities. The youth who participated in the summer were very excited when visiting the bog, many students had not been to that location and if they had they did not know about the carnivorous pitcher plants. During the interviews students noted this as one of their favourite places during the camp, and as something new they had learned about their community.

"The bog [was one of my favourite places I visited]. … cause you find those pitcher plants… [and I like] finding the little larvae in there." (Participant #3)

"It [the bog] was quite an experience… learning about the plants [pitcher plants]." (Participant #4)

The students' enthusiasm shows that there is interest among youth to learn about their community and environment. Presenting students with unique and interesting locations and elements in and around their community aids in keeping them interested in their environment, as well as builds on their understanding of what surrounds them (Gruenewald, 2003, Okada et al., 2002, Sobel, 2008). It is our hope that by building on students' interest and knowledge of their community that it will provide the foundation to allow them to represent their community's unique cultural and environmental needs in future planning decisions and negotiations (Gruenewald, 2003; Turner, 2005; Sobel, 2008).

3.3.2 Global Positioning System

The GPS devices allowed students to capture visual documentation of their experiences and upload them onto the collaborative-geomatics informatics tool. The use of these devices required students to utilize their technological skills and when asked, most students noted they were able to easily use the GPS units, as the units were similar to other technology they used on a regular basis:

> *"[The GPS was easy to use] because it was touchable and I have an iPod Touch."* (Participant #6)

> *"[The] first time you taught me in the summer… [so] I got the hang of it [so it was easy to use this time]."* (Participant #8)

The devices also delivered the added benefit of providing students with an opportunity to learn and utilize orienteering skills (e.g., map and compass reading), and complements First Nations ways of travelling by utilizing landmarks and locations (Churchill et al., 2010; Broda & Baxter, 2002, Aporta, 2005). The use of the GPS unit also permitted students to create their own "visual representation" of their community through pictures and waypoints of locations, plants, and other objects they found to be interesting or significant (Broda & Baxter, 2002: 158). The students noted their enjoyment of being able to take pictures with the GPS and learn how to read a map and compass.

"[I liked taking] pictures and using the compass." (Participant #8)

"I like the map like using it to know where to go… and it was easier than the compass." (Participant #7)

"…it [the GPS] had most everything on it that we needed… like a camera, or when like when the sun would come up…" (Participant #6)

The GPS units enhanced the students' understanding of their environment by connecting the youth to locations and objects by applying various skills, such as, orienteering, traditional plant identification, photography, etc. (Okada et al., 2002). The camp activities had students collect photographic data related to their community to upload to the collaborative-geomatics informatics tool. In terms of future planning, orienteering skills as well as capturing geo-referenced photographs can be very helpful for monitoring changes in the environment. By developing these skills today, youth can more fully participate in the collection of data for the collaborative-geomatics informatics tool (Kral, 2010).

3.3.3 Collaborative-Geomatics Informatics Tool

Most students found the collaborative geomatics easy to use after a brief tutorial and were comfortable navigating through the tool. When questioned about any difficulties they had with using the tool, students' comments focused on issues surrounding ease of usability. These comments will be used to further develop the tool so that all community members can easily use it:

> *"I don't know what those symbols were [referring to the symbols on the map]... where you have to edit or something."* (Participant #9)

> *"When you want to look at the pictures I don't know [where] to click."* (Participant #9)

Nonetheless, students' responses were quite positive and most showed a great level of interest for learning about their environment and utilizing the tool:

“[I would like to learn about] how to… how do you know where there’s thin ice and stuff, like when you go hunting.” (Participant #9)

“I want to learn about the Old Post.” (Participant #7)

Although some students noted that they had access to information about the community through family members and opportunities to participate in cultural activities such as hunting, Fort Albany is no different with respect to the trend of loss of community specific knowledge in Aboriginal communities (Tsuji, 1996b; McDonald et al., 1997; Pearce et al., 2009; Ford et al., 2008). Students’ responses were similar to those of adults reported in a study by Barbeau et al., (2011), indicating that the collaborative-geomatics informatics tool has the potential to help youth learn more about their community. Indeed, youth identified potential uses for the GPS devices and the informatics tool:

“[I would use the collaborative-geomatics informatics tool to learn about] hunting spots” (Participant #9)

“[I would use the collaborative-geomatics informatics tool] if I get lost or something… where to go [and to see] how it [a location] looks” (Participant#9).

These responses show that students were able to see the informatics tool's potential for enhancing learning about the community through its ability to act as a "representational and connectivity tool" (Churchill et al., 2010: 57; Aporta, 2005). The collaborative-geomatics informatics tool also provides the additional benefit of augmenting student-centered learning, through its social networking feature which allows students and community members to communicate and share various data (e.g., videos, pictures, audio) with one another (Churchill et al., 2010; Christie, 2007; Sugimoto et al., 2006).

A final theme that emerged from the interviews was the student's interest in learning about and participating in cultural activities (e.g., learning bush skills). When asked which activity was their favourite, most students noted the fire building activity:

> *"[My favourite] activity was making the fire… [because] you can practice doing survival in the bush"* (Participant #8).

> *"[I would like to learn about] how to make a fire"* (Participant #9).

> *"[I would like to learn about] those other fun stuff we did [the outreach camp activities]… like the bog, the dike, fossils and stuff"* (Participant #8).

This theme supports that there is interest among the youth of Fort Albany to learn about TEK (e.g., bush skills). Building on this interest, the collaborative-geomatics informatics tool can help transmit TEK to the younger generation, while also allowing the youth to see and understand the community's unique historical and cultural aspects.

Having an understanding of what defines a community allows youth to care for it and provides the basis for making well informed decisions in the future that impact their environment (Gruenewald, 2003; Okada et al., 2002, Sobel, 2008). Students' enthusiasm and positive feedback demonstrates that incorporating the technologies into the place-based education model was successful for engaging them to utilize the technologies within their community and environment (Kral, 2010; Smith, 2002; Bartholomaeus, 2006). Further, the youth being able to use the GPS unit and collaborative-geomatics informatics tool in such a short period of time, appears to indicate that if given the opportunity, they will continue to use the technology in the future for various purposes (e.g., planning).

Continuation of the outreach program to further engage the youth of this community is planned, and there is also the potential to integrate the informatics tool into the school's curriculum. Integration of this tool into the school's curriculum could greatly benefit the community by increasing the youth's interest and knowledge of their community and environment. The present study illustrates the potential use of western science (e.g., mapping technology) and TEK in a complementary way, as has been suggested by Tsuji & Ho. (2002).

Notes

[1] In Canada, Aboriginal is defined as being of First Nations, Inuit or Metis ancestry.

[2] TEK encompasses all Aboriginal knowledge. Historically, TEK was transmitted orally and by watching and doing (Tsuji & Ho, 2002). In this way, knowledge of the environment and skills important to surviving in and adapting to the environment were passed between generations (Wheaton, 2000; McNally, 2004).

[3] GIS allows people to create maps that display geospatial data, such as, watersheds, at various geographical scales (Cusimano et al., 2007).

[4] Geomatics is a "larger area of inquiry which contains GIS" (Cusimano et al., 2007: 51). Geomatics focuses on organizing "geographically referenced data, visualization of data on maps and graphs, and the spatial analysis of data" (Cusimano et al., 2007: 51). The collaborative-geomatics informatics tool has some similarities to GIS, as it is also a mapping tool; however, the collaborative-geomatics tool is web-based and allows for collaboration and communication (e.g., visual, oral) between users (Cowan et al., 2006; Barbeau et al., 2011).

[5] Due to changes in technology and a move towards a more wage-based economy many First Nation youth spend less time out on the land participating in traditional activities, and more time in formal learning environments (Tsuji & Nieboer, 1999; Tsuji, 1996b). This shift has given the younger generation the opportunity to learn about and use technologies, such as, computers; however, more time in a classroom has led to fewer opportunities to go out on the land and learn about their community and environment and gain the associated knowledge (Tsuji & Nieboer, 1999; Tsuji, 1996b; Berkes & Jolly, 2001). This loss in knowledge among the younger generation of First Nation youth not only carries cultural consequences, such as, loss of language and practices, but will also impact how future generations respond to issues such as environmental change (McCarthy et al., 2011; Ford et al., 2008; Pearce et al., 2009; Huntington et al., 2005; Barbeau et al., 2011).

[6] In the James Bay region, sea-level change is dominated by post-glacial rebound (i.e., land emergence) from the unloading of the earth's crust associated with the melting of the Laurentide ice sheet (Tsuji et al., 2009).

CHAPTER 4: Sustaining A Local-Food Security Initiative In a Remote Subarctic Community: Engaging Canadian First Nation Youth in Agroforestry-Community Gardens

4.1 Introduction

Food security in a community "exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (Food and Agriculture Organization of the United Nations, 1996: paragraph 13). Remote northern First Nation communities experience unique challenges when attempting to address food security. For example, the location of northern communities often limits accessibility, requiring food to be flown in by plane. This in turn causes higher prices of food when compared to more southern communities (Tsuji, 1998; Gates et al., 2012a); it also impacts the quality of non-perishable foods such as fruits, vegetables and meats (Downs et al., 2009; Gates et al., 2012a; Skinner et al., 2006). In addition, many remote northern First Nation communities have high rates of unemployment and relatively low incomes. These factors limit access to those foods that are deemed healthier, for many individuals (Aboriginal Affairs and Northern Development, 2012; Statistics Canada, 2006). This leaves processed foods higher in fat, sugar and salt content, and lower in cost as the only option, other than traditional (e.g., wild meats and fish) foods (Skinner et al., 2006; Gates et al., 2011; Gates et al., 2013).

These barriers to food security have resulted in an increasing prevalence of overweight and obesity (Gates et al., 2012b), as well as obesity-related diseases, such as, type 2 diabetes among First Nation populations (Popkin & Gordon-Larsen, 2004; Shields

& Tjepkema, 2006; World Health Organization [WHO], 2000). In order to combat these issues, many communities are focusing on making healthy foods, such as, fruits and vegetables more available and accessible through local-food initiatives. Interventions have been initiated that revitalize traditional food practices and/or introduce new food practices, such as, gardening and agroforestry (Spiegelaar, 2011; Stroink & Nelson, 2009; Pearce et al., 2009). Moreover, some researchers have come to view global warming as an opportunity to grow fruits and vegetables, as the growing season has been prolonged (Schuur et al., 2008), especially in subarctic and arctic regions where global warming effects have been disproportionate (Hori et al., 2012).

In 2011, our research group initiated home and agroforestry-community gardens in collaboration with Fort Albany First Nation Chief & Council (i.e., locally-elected First Nation governing body) and community members (Spiegelaar, 2011). Agroforestry is an ancient practice of combining woody shrubs (including trees) with crops. Agroforestry has the potential to act as a more reliable local-food system because it will increase the availability and consumption of fresh vegetables and fruits, improving nutrition and well-being of community members in Fort Albany by decreasing reliance on costly imports (Spiegelaar, 2011).

It is important that the home and agroforestry-community gardens intervention involves youth of Fort Albany, as youth involvement will be needed to sustain the initiative. By including youth in this intervention, unique and insightful knowledge and perspectives can be provided (Chen et al., 2010). In expanding this initiative, as well as moving towards ensuring its sustainability, it is important that youth have the opportunity to learn about the home and agroforestry-community gardens intervention and become more engaged in this community-based activity. The outreach initiative we will describe is in response to community inquiries regarding local-food security and how youth may become more engaged in community-based initiatives to enhance food security. The outreach camp also aimed to gain insight into youth perspectives on food security.

4.2 Methods

4.2.1 Study Community

The community of Fort Albany First Nation is located in subarctic Ontario, Canada. Ontario is the most populated province in the country with the majority of its residents residing in the southern region. The northern region of Ontario (which includes the subarctic) accounts for over 40% of the province's landmass, and contains ~450, 000 km^2 of boreal forest, peatland, wetland and tundra (Ontario Ministry of Natural Resources, 2010). Fort Albany is located near the mouth of the Albany River in the western James Bay region of northern Ontario. Fort Albany is considered remote, as it is only accessible year-round by plane, and when the ice road is in operation, by truck and snowmachine. The community has a population of approximately 850 people, many of whom partially subsist off the land (e.g., hunt and fish; Tsuji, 1996b). It shares many social issues noted for other First Nation communities in Canada, such as, poverty and unemployment (Fort Albany First Nation, 1999: "Community Profile").

4.2.2 Participants

Peetabeck Academy is the local school in the community and provides education for grades junior kindergarten to 12. Our team worked in partnership with the Mundo Peetabeck Education Authority – the administrative body for the school and all educational matters in Fort Albany – using their consent forms and facilities. The number of students attending the camp varied from 8 to 15, dependent on the day. A local community member recruited ten youth in grades 6 to 8 to participate in the camp. The number of youth was originally capped at ten, as this ratio of youth to camp leaders (graduate students and professors) was found to be the most effective for ensuring that youth get proper attention for understanding the material and participating in the activities (Karagatzides et al., 2011; Isogai et al., 2012; Isogai et al., 2013a). The age group of the youth considered for the camp was determined based on their ability to participate in the activities as well as another goal of the outreach camp, which is to encourage youth to stay in school, as drop out rates increase closer to high school (Karagatzides et al., 2011).

4.2.3 Environmental-Outreach Camp

An environmental-outreach camp was used as a platform to engage youth in the local-food initiative within the community. Environmental-outreach camps have been held for the past eight years with the Mundo Peetabeck Education Authority, with all camps focusing on providing youth the opportunity to participate in hands-on activities that bring awareness about the local environment and changes occurring within it (Karagatzides et al. 2011; Isogai et al., 2012; Isogai et al., 2013a). The home and agroforestry-community gardens camp was held on July 16-20, 2012. The last day was used for a community dinner, where the parents and youth were invited to eat and watch a slideshow on what the youth had done that week.

Each day had a theme attached to it, often in the form of a question (e.g., “where does food come from?”). This helped to provide direction for the material to be delivered on that day as well as the activities they participated in. On a daily basis, mornings were used to introduce youth to the topic for that day and give them some background knowledge. Subsequently, we would move outside into the community to participate in relevant activities with respect to the discussion in the morning (e.g., berry picking with a local bushman).

The camp was guided by youth participatory action research (YPAR) (Cammarota & Fine 2008; Chen et al., 2010; Dold & Chapman, 2011). Inclusion of youth in research is commonly overlooked, which can lead to a missed opportunity for a boarder perspective on issues (Chen et al., 2010). Literature has shown and described many benefits to engaging youth in research including, “contributing to social justice and the reshaping of power dynamics within the community” (Chen et al., 2010: 230). Participatory Action Research is an approach that focuses on collaboration among the researchers and the general population, and strives to have the community’s voice “heard and respected” (Cammarota & Fine, 2008: viii). It goes beyond seeing the public as participants in a study but as co-researchers removing “the notion of the so-called expert to encompass a wider range of stakeholders” (Cammarota & Fine, 2008: viii; Chen et al., 2010; Dold & Chapman, 2011). This collaboration makes PAR a “powerful tool” for marginalized populations, such as, Indigenous youth (Dold & Chapman, 2011: 512). Youth participatory action research provides youth with the “opportunity to engage with a larger community, build self-confidence, and develop effective research and problem solving skills” (Zeldin et al., 2006 as cited in Dold & Chapman, 2011: 518). By utilizing YPAR, we wanted our research to go beyond bringing awareness to youth on food security in their community, but also provide them with the tools to become involved in the issues surrounding this emerging topic. In this way, Fort Albany can benefit from the youths' knowledge and perspectives.

4.2.4 Photovoice

Photovoice was chosen as it is flexible, and integrates participants into the research process (Wang & Burris, 1997). The use of photovoice is also sensitive to marginalized groups of people, as it is easy to learn, only requiring a person to be able to use a camera and take photographs in response to certain questions (Wang & Burris, 1997). This was an important aspect for choosing photovoice as a method, since the youth who participated had varying levels of literacy and comprehension; this method allowed all to participate at the same level.

Each morning of the camp the youth were given a specific question to answer using a photograph, such as "where does food come from?" They were then given time and a camera-ready Garmin Oregon 550 Global Positioning System (GPS) device to go out and take a few photographs. The use of the Garmin Oregon 550 GPS was chosen over a point-and-shoot or digital camera, as this GPS unit includes a built in camera that allowed students to take pictures and have the geospatial information automatically connected to the photographs.

Students then came back to the school, chose a photograph that best answered the question and then uploaded that photograph to the collaborative-geomatics informatics tool. The collaborative-geomatics informatics tool is unique compared to other participatory, geospatially-based systems, as we use the Web Informatics Development Environment (WIDE) toolkit (McCarthy et al., 2011; Cowan et al., 2006). The WIDE toolkit was developed by the Computer Systems Group of the University of Waterloo and utilizes a wizards-based approach to system construction, allowing for the relatively rapid development and modification of the system (McCarthy et al., 2011; Cowan et al., 2006). Thus, the WIDE toolkit facilitates greater community engagement by supporting relatively quick customization of each collaborative-geomatics informatics tool (McCarthy et al., 2011; Gardner-Youden et al., 2011b).

Subsequently, students completed a short oral narration describing the photograph. To facilitate the oral narration, students were given a set of questions to help guide their narrations of the photographs and answer the overall question, following Wang et al. (2004: 912). Students were partnered and interviewed one another using the questions provided. This was found to be more effective than one of the research members asking, as the students were more comfortable and open to talking to one another (Morgan et al., 2002). These interactions were recorded on the computer, to be transcribed and analyzed for emerging themes. The Wang et al. (2004: 912) questions were utilized on the first day; however, through participant observation notes, it was quickly realized that students did not meet the literacy and comprehension level required. Thereafter, the questions were just used as an outline, and modified each day to meet the abilities of the students and complement the learning outcome for that day.

Youth were first introduced to the GPS units and the collaborative-geomatics mapping tool in the summer of 2011; the system was found to be successful for engaging youth in learning about their community and environment, as well as showed potential for transferring intergenerational knowledge between Elders and youth (Isogai et al., 2012; Isogai et al., 2013a). The GPS devices and mapping system were used this time to provide youth with a visual-geospatial representation of food sources located in the community; while, also having the opportunity to continue to familiarize themselves with the collaborative-geomatics mapping tool.

4.2.5 Collective Reflection

Similar to a "sharing circle", collective reflection seeks to devolve power from the researchers, encourage story-telling, and invite the co-creation of knowledge between researchers and participants through the presentation of story as narrative (Kovach, 2010). Identifying and addressing issues of power between researchers and participants is a key difference between collective reflection and focus groups. In addition, using a minimally structured, conversational approach to group discussion that focuses on partnerships - as opposed to the researcher/participant separation - has been identified as an appropriate method in the context of youth and Indigenous participants (Kovach, 2010; Chen et al., 2010). The purpose of using this methodology was to empower youth to perform group analysis and interpretation of daily photovoice assignments.

The collective reflection exercise had two main components: reflection with respect to the photographs; and reflection about the research process itself. On each day of the camp, the youths' chosen photovoice images were merged into a collage and displayed using PowerPoint. Drawing on the individual narration, youth were prompted to discuss the photographs with the group by revisiting the photovoice assignment questions for the day. These reflections were recorded and transcribed to look for emerging themes and verify the individual narrations completed by the students (Chen et al., 2010; Wang et al., 2004). Two members of the research team were present to take down notes to help support the recordings and highlight any key points. This group discussion added a second layer of analysis to the interpretation of the photovoice assignments and helped to collaboratively identify and verify emerging themes or patterns in the youths' perceptions of food security in Fort Albany (Wang et al., 2004; Wang & Burris, 1997).

4.3 Data Analysis

The data collected were split up by day (i.e., day 1, day 2, and day 3); all the individual data from each day were collected and analyzed together. The collective reflections were then done in the same manner, and were used to verify the data from the individual narratives as well as identify other emerging themes that did not come about during the individual narratives.

When utilizing photovoice, analysis of the data occurs throughout, as it is an ongoing process as described by Wang & Burris (1997: 380):

1. Photograph selection: By having the students choose a photograph to discuss each day allowed the subjectivity of that photo to be based on the youths' judgment views and opinions which were also guided by the question for that day.
2. Contextualizing: After youth had chosen their photograph each answered questions related to that day's overall theme – giving further insight into how that photo relates to the theme for that day and of course to themselves.
3. Codifying: The collective reflection time was used to see all of the youth's photographs together, this gave them the opportunity to analyze and observe the photographs allowing any themes, images, representations or comparisons to emerge. The photographs were then further analyzed by the researchers for any themes and were verified by the recorded individual and collective discussions.

Other data analysis methods were used to support, verify and strengthen the analysis process. Participant observation was used in order to capture the youths' true/candid reactions and interactions while out in the field. Field notes were used to record these reactions, and helped to increase the validity of emerging themes, comparisons, and indicate any further themes that may have been overlooked (Darbyshire et al., 2005; Barbeau et al., 2011; Bryman, 2001; Churchill et al., 2010; Heath & Walker, 2012).

Critical reflection occurred in two stages. Firstly, during the daily collective reflections with youth, where the photographs and probing questions were used to help youth make connections, see themes and further elaborate on interpretations of imagery (Chen et al., 2010). Secondly, when the group and individual discussions were transcribed and analyzed for themes, inductively (Bryman et al., 2009). This helped in identifying patterns and themes in the youths' perceptions of food security, as well as analyze and verify the themes that emerged from the individual narratives. Inductive analysis was used to see what themes emerged from the youths' perspectives and knowledge. Inductive analysis allowed data to be analyzed openly without a framework of pre-determined themes or categories (Kovach, 2010; Bryman et al., 2009). Lastly, data verification was undertaken in December 2012, to verify the accuracy of the theme analysis with the participants.

4.4 Results

Day 1: "Where does food come from?"

The first day of the camp looked at where food comes from, discussing with the youth the various options for getting food. The majority of responses (photographs) to this question were gardens and the bush (e.g., berries). These answers were not very surprising as they were discussed and used in the activities throughout the day (Figure 5).

Figure 5: Day 1 Photographs.

Nonetheless, students' displayed a wide range of knowledge in understanding how gardens and the bush provide food and where they can find it in their community (Table 2).

"[Student's name] is holding a strawberry… and she found it at a place at… [community member's name] place." (Participant 1)

"Say if we're out camping and a bear takes our stuff, we can go collect some tea and um… berries." (Participant 6)

Table 2: Day 1 Themes.

Where Does Food Come From?	**Sub-Themes**
A Garden	• Community Gardens
	• Home Gardens
	• What is Needed to Build a Garden
	• Gardens Provide Healthy Foods
	• Gardens Provide an Alternative Food Source
	• Gardens Grow Edible Plants
Traditional/Bush Resources	• The Cultural Value
	• Berries
	• Labrador Tea

During the collective reflection, youths' responses also showed their knowledge and awareness of food security issues occurring within the community, as well as how places such as gardens and the bush can help improve these issues.

"…we need more berries to grow here and we would like to get [a] garden… and stuff and get more plants to grow…" (Participant 1)

"We can take them (Labrador tea and berries) to make them into juice and make tea…" (Participant 6)

Day 2: "What is your Favourite Food?"

The second day we asked the youth what their favourite food was (Figure 6). However, since the local store was quite a walk from the school, we allowed the youth to use other things to represent their favourite food. The youth were quite creative in how they presented their favourite foods; however, the common themes that emerged from the individual narratives and collective reflection were that most came from the store and tended to be foods that were high in calories, fat, and sugar; all of which are meant to be limited according to the Canadian Food Guide for Healthy Eating (Health Canada, 2011).

"[My favourite food is] um chicken burgers and fries." (Participant 12)

"… I like potato chips… [and] chocolate." (Participant 4)

When discussing their favourite foods during the individual and collective reflection, the youth were able to make the connection between food and how it impacts an individual's health (Table 3).

"hmmm… unhealthy foods like… fast foods or something [are not helping Fort Albany with food security]." (Participant 6)

"I know what was helping Fort Albany… Vegetables, making them stronger…" (Participant 1)

Figure 6: Day 2 Photographs.

Table 3: Day 2 Themes.

Ability to link health and food	• Vegetables are healthy
	• Gardens grow vegetables
	• Limit "Junk Food" to Improve Food Security
Suggestions to Improve Food Security in the Community	• Limit the availability of fast food
Food Insecurity in the Community	• Availability of Junk Food
	• Hunger

Day 2 really brought about the youths' recognition of issues surrounding food security in the community, and with this they also were able to suggest solutions to these issues (Darbyshire et al., 2005; Morgan et al., 2002). It also highlighted the youths' ability to learn and utilize a research process, such as, photovoice and apply it to learn about a complex term (i.e., food security) and take that understanding and apply it in their community (Darbyshire et al., 2005; Morgan et al., 2002).

Day 3: "Pick a food that is 'food secure.'"

Throughout the week the youth had been learning about the term "food security" and what it meant for a community. On this day they needed to apply this knowledge and use it in their data collection. The camp leaders broke the term "food security" down into a criterion that the youth would have to look for when choosing a food that was "secure." The food they chose to photograph had to be healthy, not expensive and available to a majority of the community. Youth responded with pictures of vegetables growing in gardens, most of them were actually of potatoes (Figure 7). Potatoes are a favourite food in the community and have become a staple part of the diet.

"I took a picture of carrots, onions and potatoes and that's it." (Participant 1)

"... we took a picture of the garden and potatoes... those big ones.. and those small teeny carrots..." (Participant 10)

"[I chose] carrots, potatoes and beans." (Participant 12)

Figure 7: Day 3 Photographs.

During both discussions youth were able to vocalize what made the foods secure, although many were focused on the physical protection of the food by the fences that surrounded the gardens that were growing the food. However, as the discussions went on some youth did mention how initiatives, such as, gardens can help provide food that is secure in that it is low cost and healthy (Table 4).

> *"It's [the garden is] good because you don't have to waste money on buying stuff ... at the Northern... and stuff... and so you can just grow your own plants and not buy them." (Participant 10)*

"It's [the garden is] good because you don't have to waste your money and you can have your own food for your family." (Participant 4)

Again, the discussions also allowed the youth to once again become aware of issues surrounding food security in their community, as well as provide recommendations and potential solutions.

"[We can improve food security by] building more gardens... planting more gardens for the community so people don't have to buy food." (Participant 13)

"It's [the garden] good for the community because um you don't have to buy them [fruits and vegetables] because they're expensive..." (Participant 12)

"...planting more gardens for the community so people don't have to buy food." (Participant 13)

Table 4: Day 3 Themes.

Day 3: Pick a food you think is food secure	• Vegetables
	• Potatoes
Why these foods are secure	• Physical Protection (i.e., Fences)
	• Provides Healthy Foods
	• Low Cost
	• Alternative to the store
	• Community Control
	• Promotes Community Sharing
	• Mitigates Hunger
Suggestions to Improve Food Security in the Community	• Plant more gardens
	• Don't waste food
Food Issues in the Community	• Lack of Food
	• Variety of places to get food
	• Cost

4.5 Discussion

By having a place-based focus, youth were able to gain new knowledge on food security and apply that knowledge in a familiar setting to problems they personally experience (Lertzman, 2002; Smith, 2002; Bartholomaeus, 2006; Biermann, 2008). The photovoice and collective reflection method really contributed to gaining insight into the youths' perspectives on food security in their community, as well as how they think it can be improved. It was inspiring and encouraging hearing the youths' responses and seeing their photographs. Advocates of place-based education highlight the importance of getting youth involved in their community and gaining their perspectives on issues and solutions - as they are a population often forgotten - but are the future community leaders and members (Biermann, 2008; Gruenewald, 2003; Sobel & Spikol, 1999).

Working with youth can pose many challenges and require a person to be extremely flexible (Berg, 2004; Kemmis & McTaggart, 2005). It was important that the research aspect not overshadow the camp experience for youth, as so many look forward to it (Karagatzides et al., 2011; Isogai et al., 2012; Isogai et al., 2013a). Initially the photovoice activity was to occur everyday of the camp (five days); however, as seen in the results only three out of the five days were completed. A major factor for this change was that the demand for the camp increased throughout the week from ten to fifteen participants - a limit of ten youth was originally planned – however, we deemed it was unfair to turn away youth who wanted a chance to participate. With the increase in participation there was a mix of youth that were new and that had been there from the start, making the photovoice assignment difficult to execute. The last days of the camp went on as planned with the learning objectives and activities, but without the photovoice component. This modification allowed the camp to meet the objectives of bringing youth awareness to the gardening intervention, increasing youth engagement in the gardening initiative, and providing a positive camp experience for youth.

These results agree with the literature on research with youth, in that the youth are aware of issues and solutions within their community and are able to provide great perspective and insight (Chen et al., 2010; Cammarota & Fine, 2008; Dold & Chapman, 2011; Darbyshire et al., 2005; Morgan et al., 2002). In fact, many of the issues and solutions recognized by the youth are similar to those mentioned by adults in Aboriginal communities (Skinner et al., 2006; Willows et al., 2005; Peloquin & Berkes, 2009; Ford et al., 2008). Although youth had issues with the jargon we used, such as, “food security”, they were able to comprehend its concepts and underlying message, which is becoming aware of barriers and solutions surrounding access to healthy food for everyone. The ability of the youth to learn the photovoice method and utilize the associated technology further shows that with the right tools and guidance youth can positively contribute towards issues, such as, food security and should continue to be involved in local matters to help them build the skills and knowledge needed to become active future community leaders and members.

The limited mention of the bush as a food source does support the emerging trend brought up in literature that Aboriginal youths’ awareness of cultural and traditional knowledge is decreasing in communities throughout Canada (Berkes et al., 1995; Tsuji, 1996b; Tsuji & Nieboer, 1999). Most of the students chose to take a picture of vegetables in a fenced garden as a secure food. Although this may be attributed to the fact that they are a healthy food, most of the youth understood secure food to be food that is physically protected, such as, by a fence. This answer may have had more variance, if youth had more opportunity to take pictures of things in the bush, as our walks were somewhat limited to where we could go due to bear and fox sightings. Another camp is already in the works for the summer of 2013, our team hopes to again focus on getting youth more engaged in other community-based, food-security interventions.

CHAPTER 5: Conclusion and future research

The purpose of this chapter is to summarize the conclusions of this research and put forth any future research to be completed in order to enhance the purposes of this study. The objective of my research was to utilize place-based learning methods and mapping technologies to engage the youth of Fort Albany First Nation in Northern Ontario to their community's activities (e.g., research, cultural, traditional, etc.) and environment. More defined, I studied the potential of the collaborative-geomatics informatics tool in engaging youth's interest in their community/environment (i.e., culture, history, traditional activities, etc.) and its ability to transmit intergenerational knowledge.

This research displayed the use of place-based education and the collaborative-geomatics informatics tool with youth in the sub-arctic community of Fort Albany, Ontario. Specifically, chapter 2 was the initial introduction of the collaborative-geomatics tool to the youth of the community through an environmental outreach program in order to determine whether using this tool while following a place-based education model could aid in intergenerational knowledge transmission (Barbeau et al., 2011; McCarthy et al., 2011; Kral, 2010; Robbins, 2003; Wattchow, 2001). The outreach program was able to connect the youth to the community members who held traditional environmental knowledge about the local area (Berg, 2004; Kemmis & McTaggart, 2005), and utilizing traditional teaching methods and place-based education, transfer this knowledge in a way that was culturally-appropriate (Battiste, 2002; Biermann, 2008; Maina, 1997; McNally, 2004; More, 1987; Wheaton, 2000). The collaborative-geomatics tool and GPS devices acted as a bridge between the two generations, by getting youth to upload traditional knowledge in forms of various geospatially-referenced multimedia (e.g., photos, videos, etc) (Broda and Baxter, 2002; Christie, 2007; Churchill et al., 2010; Sugimoto et al., 2006). Youth in this community have grown up using various technology (e.g., the internet, video games, etc.), thus acquiring a greater knowledge base and comfort level with using new technologies such as the collaborative-geomatics tool (Barbeau et al., 2011). The mapping technology allowed two generations to share knowledge and skills they were each strong in allowing for a mutual transfer of knowledge. This route of transmission needs to be explored further, because even though youth have good technological skills and can see the potential uses of the informatics tool, it does not mean they will actually use the informatics tool for this purpose.

Chapter 3 expanded this study's outlook by further exploring the potential of the collaborative-geomatics tool with youth by examining whether place-based education could be used to engage youth to their local environment utilizing the collaborative-geomatics informatics tool. A second camp was held in the fall of 2011, and the youths' ability to quickly learn the tool and vocalize examples of ways it can be used showed that it has potential to be used by youth in the future, providing confidence in the tools future sustainability within the community (Churchill et al., 2010: 57; Aporta, 2005). An added benefit arose in the tools prospective to be used in the educational curriculum as a way of incorporating the community's need of getting youth more connected with the local environment and their community (Barbeau et al., 2011; Churchill et al., 2010; Christie, 2007; Sugimoto et al., 2006).

Chapter 4 responded to community inquiries regarding local-food security and engaging youth in the current community-based initiatives, to help ensure their long-term sustainability (Spiegelaar, 2011). The outreach program was once again used to gain insight on youths' perspectives surrounding food security in their community as well as barriers and opportunities to reaching local food security. Photovoice and hands-on activities were used to engage and teach youth about food security and the local initiatives in place (e.g., home gardens) (Wang & Burris, 1997; Cammarota & Fine 2008; Chen et al., 2010; Dold & Chapman, 2011). Youth used GPS devices to take photographs related to food security in their community, providing a unique insight into their perspectives on the issue (Chen et al., 2010; Cammarota & Fine, 2008; Dold & Chapman, 2011; Darbyshire et al., 2005; Morgan et al., 2002). The youth were able to express issues and opportunities surrounding food security in their community during group and individual discussions and their photographs. Many of the issues and solutions recognized by the youth are similar to those mentioned by the adult population (Skinner et al., 2006; Willows et al., 2005; Peloquin & Berkes, 2009; Ford et al., 2008). It is recommended that the community continue to provide opportunities and activities such as the outreach program in order to get youth involved in community matters and become active future community leaders and members.

Future research should focus on providing the community with the resources and tools to provide self-sufficient programming for youth. This will allow them to have full control over what the focus for the programs are and how they want the youth engaged. Finally, by involving more local community members the programming can help them continue to build on their needs such as bridging the gap between generations.

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